AMENDMENTS TO THE CLAIMS

Please enter the following amendments:

1. (Currently Amended) An apparatus for determining, based on speech waveform data, a portion representing a feature of the speech waveform, comprising:

an acoustic/prosodic analysis unit which calculates ~~extracting means for calculating~~, from said data, a distribution of energy of a prescribed frequency range of said speech waveform along a time axis, and ~~extracting~~ extracts, among various syllables, a first portion of said speech waveform that is generated stably by a source of said speech waveform, based on the distribution of energy and pitch of said speech waveform;

a cepstral analysis unit which calculates ~~estimating means for calculating~~, from said data, a frequency spectrum distribution of said speech waveform along the time axis, and ~~estimating~~ estimates, based on the frequency spectrum distribution, a second portion of said speech waveform, for which change is well controlled by said source; and

a pseudo-syllabic center extracting unit which determines ~~means for determining~~ the portion representing the feature of said speech waveform based on the first portion extracted by ~~said extracting means~~ the sonorant energy calculating unit and the second portion estimated by ~~said estimating means~~ the cepstral analysis unit, wherein

said cepstral analysis unit includes:

a linear prediction analysis unit which performs linear prediction analysis on said speech waveform and outputting an estimated value of formant frequency;

a cepstral distance calculating unit which calculates, using said data, a distribution of cepstral distance on the time axis based on the estimated value of formant frequency provided by said linear prediction analysis unit;

an inter-frame variance calculating unit which calculates, based on an output from said linear prediction analysis unit, distribution of local variance of magnitude of delta cepstrum of said speech waveform on the time axis; and

a reliability center candidate output unit which estimates, based both on said distribution on the time axis based on the estimated value of formant frequency calculated by said cepstral distance calculating unit and on said distribution on the time axis of local variance of magnitude of delta cepstrum of said speech waveform calculated by said inter-frame variance calculating unit, a range in which change in the speech waveform is well controlled by said source.

2. (Currently Amended) The apparatus according to claim 1, wherein

said ~~extracting means~~ acoustic/prosodic analysis unit includes:

a pitch determining unit which determines ~~voiced/unvoiced determining means~~ ~~for determining~~, based on said data, whether each segment of said speech waveform is a voiced segment or not,

a dip detecting unit which separates ~~means for separating~~ said speech waveform into syllables at a local minimum of said waveform of energy distribution of the prescribed frequency range of said speech waveform on the time axis; and

a voiced/energy determining unit which extracts ~~means for extracting~~ that range of said speech waveform which includes, in each syllable, an energy peak in that syllable within the segment determined to be a voiced segment by said ~~voiced/unvoiced determining means~~ pitch determining unit and in which the energy of the prescribed frequency range is not lower than a prescribed threshold value.

3. (Canceled)

4. (Currently Amended) The apparatus according to claim 1, wherein

said pseudo-syllabic center extracting unit ~~determining means~~ includes:

means for determining a range included in the range extracted by said ~~extracting~~ ~~means~~ acoustic/prosodic analysis unit, within the range of which change in speech waveform is estimated by said ~~estimating means~~ cepstral analysis unit to be well controlled by said source.

5 – 6. (Canceled)

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7. (Currently Amended) An apparatus for determining a portion representing a feature of a speech signal, comprising:

a linear prediction analysis unit which performs ~~predicting means for performing~~ linear prediction analysis on said speech signal;

a cepstral distance calculating unit which calculates ~~first calculating means for calculating~~, based on an estimated value of formant provided by said linear prediction analysis unit ~~predicting means~~ and said speech signal, a distribution of cepstral distance, along time axis, based on the estimated value of formant;

an inter-frame variance calculating unit which calculates ~~second calculating means for calculating~~, based on a result of the linear prediction analysis by said linear prediction analysis unit ~~predicting means~~, a distribution, ~~along time axis,~~ of a variance of local ~~spectral change~~ magnitude of delta cepstrum in said speech signal along the time axis; and

~~means for estimating~~ a reliability center candidate output unit which estimates, based on the distribution based on the estimated value of formant calculated by said ~~first calculating means~~ cepstral distance calculating unit and the distribution of variance of local ~~spectral change~~ magnitude of delta cepstrum in said speech waveform calculated by said ~~second calculating means~~ inter-frame variance calculating unit, a portion of said speech waveform in which a change in said speech waveform is well controlled by said source.

8. (Currently Amended) A ~~program product causing, when executed on a computer, said computer~~ machine readable medium having data stored thereon, the data, once read by the machine, causing the machine to operate as an apparatus for determining, based on speech

waveform data, a portion representing a feature of the speech waveform, said apparatus comprising:

an acoustic/prosodic analysis unit which calculates ~~extracting means for calculating~~, from said data, distribution of energy of a prescribed frequency range of said speech waveform along a time axis, and extracting, among various syllables, a first portion of said speech waveform that is generated stably by a source of said speech waveform, based on the distribution of energy and pitch of said speech waveform;

a cepstral analysis unit which calculates ~~estimating means for calculating~~, from said data, a frequency spectrum distribution of said speech waveform along the time axis, and estimating, based on the frequency spectrum distribution, a second portion of said speech waveform, for which change is well controlled by said source; and

a pseudo-syllabic center extracting unit which determines ~~means for determining~~ the portion representing a feature of said speech waveform based on the first portion extracted by ~~said extracting means~~ the sonorant energy calculating unit and the second portion, wherein

said cepstral analysis unit includes:

a linear prediction analysis unit which performs linear prediction analysis on said speech waveform and outputting an estimated value of formant frequency;

a cepstral distance calculating unit which calculates, using said data, a distribution of cepstral distance on the time axis based on the estimated value of formant frequency provided by said linear prediction analysis unit;

an inter-frame variance calculating unit which calculates, based on an output from said linear prediction analysis unit, distribution of local variance of magnitude of delta cepstrum of said speech waveform on the time axis; and

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a reliability center candidate output unit which estimates, based both on said distribution on the time axis based on the estimated value of formant frequency calculated by said cepstral distance calculating unit and on said distribution on the time axis of local variance of magnitude of delta cepstrum of said speech waveform calculated by said inter-frame variance calculating unit, a range in which change in the speech waveform is well controlled by the source.

9. (Currently Amended) The ~~program product~~ machine readable medium according to claim 8, wherein

said ~~extracting means~~ acoustic/prosodic analysis unit includes:

a pitch determining unit which determines ~~voiced/unvoiced determining means for determining~~, based on said data, whether each segment of said speech waveform is a voiced segment or not,

a dip detecting unit which separates ~~means for separating~~ said speech waveform into syllables at a local minimum of said waveform of energy distribution of the prescribed frequency range of said speech waveform on the time axis; and

a voiced/energy determining unit which extracts ~~means for extracting~~ that range of said speech waveform which includes, in each syllable, an energy peak in that syllable within the segment determined to be a voiced segment by said ~~voiced/unvoiced determining means~~ pitch determining unit and in which the energy of the prescribed frequency range is not lower than a prescribed threshold value.

10. (Canceled)

11. (Currently Amended) The ~~program product~~ machine readable medium according to claim 8, wherein

said pseudo-syllabic center extracting unit ~~determining means~~ includes:

means for determining a range included in the range extracted by said ~~extracting means~~ acoustic/prosodic analysis unit, within the range of which change in speech waveform is estimated by said ~~estimating means~~ cepstral analysis unit to be well controlled by said source.

12. (Canceled)

13. (Currently Amended) A ~~program product causing, when executed on a computer, said computer~~ machine readable medium having data stored thereon, the data, once read by the machine, causing the machine to operate as an apparatus for determining a portion representing a feature of a speech signal, said apparatus comprising:

a linear prediction analysis unit which performs ~~predicting means for performing~~ linear prediction analysis on said speech signal;

a cepstral distance calculating unit which calculates ~~first calculating means for calculating~~, based on an estimated value of formant provided by said linear prediction analysis unit ~~predicting means~~ and said speech signal, a distribution of cepstral distance along time axis on the estimated value;

an inter-frame variance calculating unit which calculates ~~second calculating means for calculating~~, based on a result of the linear prediction analysis by said linear prediction analysis

unit ~~predicting means~~, a distribution ~~along time axis~~ of a variance of local ~~spectral change~~ magnitude of delta cepstrum in said speech signal <u>along time axis</u>; and

~~means for estimating~~ <u>a reliability center candidate output unit which estimates</u>, based on the distribution based on the estimated value of formant calculated by said ~~first calculating means~~ <u>cepstral distance calculating unit</u> and the distribution of variance of local ~~spectral change~~ magnitude of delta cepstrum in said speech waveform calculated by said ~~second calculating means~~ <u>inter-frame variance calculating unit</u>, a portion of said speech waveform in which a change in said speech waveform is well controlled by said source.

14. (Currently Amended) A method of ~~determining, based on~~ <u>extracting from a</u> speech waveform data[[,]] a portion representing a feature of the speech waveform, comprising the steps of:

calculating, from said data, a distribution of energy of a prescribed frequency range of said speech waveform along a time axis, and extracting, among various syllables, a first portion of said speech waveform, that is generated stably by a source of said speech waveform, based on the distribution of energy and pitch of said speech waveform;

calculating, from said data, a frequency spectrum distribution of said speech waveform along the time axis, and estimating, based on the frequency spectrum distribution, a second portion of said speech waveform, for which change is well controlled by said source; and

<u>extracting</u> ~~determining~~ the portion representing a feature of said speech waveform based on the first portion extracted in said extracting step and the second portion, <u>wherein</u>

<u>said estimating step includes:</u>

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performing linear prediction analysis on said speech waveform and outputting an estimated value of formant frequency;

calculating, using said data, a distribution of cepstral distance on the time axis based on the estimated value of formant frequency provided in said step of outputting the estimated value;

calculating, based on the calculated distribution based on the estimated value of formant frequency, distribution of local variance of magnitude of delta cepstrum of said speech waveform on the time axis; and

estimating, based both on said calculated distribution on the time axis related to the estimated value of formant frequency and on said calculated distribution on the time axis of local variance of magnitude of delta cepstrum of said speech waveform, a range in which change in the speech waveform is well controlled by said source.

15. (Currently Amended) The method according to claim 14, wherein said step of extracting ~~step~~ a first portion of said speech waveform includes the steps of:

determining, based on said data, whether each segment of said speech waveform is a voiced segment or not,

detecting a local minimum of said waveform of energy distribution of the prescribed frequency range of said speech waveform on the time axis, and separating said speech waveform into syllables at the local minimum; and

extracting that range of said speech waveform which includes, in each syllable, an energy peak in that syllable within [[the]] a segment determined to be a voiced segment ~~by said~~

~~voiced/unvoiced determining means~~ and in which the energy of the prescribed frequency range is not lower than a prescribed threshold value.

16. (Canceled)

17. (Currently Amended) The method according to claim 14, wherein

said ~~determining~~ step <u>of extracting the portion representing a feature of said speech waveform</u> includes the step of:

determining, as a portion of said speech waveform, a range included in the range extracted in said extracting step, within the range of which change in speech waveform is estimated in said estimating step to be well controlled by said source.

18 – 22. (Canceled)

23. (Currently Amended) An apparatus as recited in claim 1, wherein

said ~~estimating means~~ <u>cepstral analysis unit is configured to calculate</u> ~~includes means for calculating~~, from said data, a frequency spectrum distribution of said speech waveform along the time axis, and ~~estimating~~ <u>estimate</u> the second portion, based on the frequency spectrum distribution, as a portion where local variance of changes of the frequency spectrum is at a local minimum.

24. (New) An apparatus as recited in claim 1, wherein

said cepstral distance calculating unit includes:

a cepstrum re-generating unit connected to receive said estimated value of formant frequency from said linear prediction analysis unit, for recalculating cepstrum coefficients based on said value of formant frequency; and

a logarithmic transformation and inverse discrete cosine transformation unit connected to receive said speech waveform data for calculating FFT cepstrum coefficients based on said waveform data, wherein

the cepstral distance calculating unit is configured to calculate cepstrum distance between the cepstrum coefficients recalculated by said cepstrum re-generating unit and the FFT cepstrum coefficients calculated by said a logarithmic transformation and inverse discrete cosine transformation unit, said cepstrum distance indicating a distribution of unreliability; and

said cepstral analysis unit includes:

a standardizing and integrating unit which combines the cepstrum distance and the distribution on the time axis of local variance of spectral change and outputting a combined data, wherein

the reliability center candidate output unit estimates the range in which change in the speech waveform is well controlled by said source at a dip of the combined data output by said standardizing and integrating unit.

25. (New) The machine readable medium according to claim 8, wherein said cepstral distance calculating unit includes:

a cepstrum re-generating unit connected to receive said estimated value of formant frequency from said linear prediction analysis unit, for recalculating cepstrum coefficients based on said value of formant frequency; and

a logarithmic transformation and inverse discrete cosine transformation unit connected to receive said speech waveform data for calculating FFT cepstrum coefficients based on said waveform data, wherein

the cepstral distance calculating unit is configured to calculate cepstrum distance between the cepstrum coefficients recalculated by said cepstrum re-generating unit and the FFT cepstrum coefficients calculated by said a logarithmic transformation and inverse discrete cosine transformation unit, said cepstrum distance indicating a distribution of unreliability; and

said cepstral analysis unit includes:

a standardizing and integrating unit which combines the cepstrum distance and the distribution on the time axis of local variance of spectral change and outputting a combined data, wherein

the reliability center candidate output unit estimates the range in which change in the speech waveform is well controlled by said source at a dip of the combined data output by said standardizing and integrating unit.

26. (New) The method according to claim 14, wherein

said step of calculating a distribution of energy includes:

receiving said estimated value of formant frequency, and recalculating cepstrum coefficients based on said value of formant frequency;

receiving said speech waveform data for calculating FFT cepstrum coefficients based on said waveform data; and

calculating cepstrum distance between the recalculated cepstrum coefficients and the FFT cepstrum coefficients, said cepstrum distance indicating a distribution of unreliability; and wherein

said estimating step further includes:

combining the cepstrum distance and the distribution on the time axis of local variance of spectral change and outputting a combined data; and

estimating the range in which change in the speech waveform is well controlled by said source at a dip of the combined data.